REMARKS

Applicant thanks the Examiner for the opportunity to discuss the prior art in a personal interview with Mr. Frank Occhiuti on June 19, 2001. Applicant now better understands the Examiner's position on the *Rabinowitz* reference.

Applicant concedes that *Rabinowitz*[1] teaches the existence of superconducting wires. Indeed, Applicant's own patent, referred to in the prior response, teaches a superconducting tape that can be used to form a winding. It is also elementary that a wire formed into a winding can have any cross-section, the essential quality of a wire (in contrast to a bulk material) being that it constrains current to flow in substantially one direction.

The Examiner appears to suggest that the choice between a superconducting winding and a superconducting bulk material in the *Rabinowitz* device is merely a design choice dictated by the inventor's preference for using brittle, but perhaps less expensive, materials. The Examiner appears to rely on an implicit disclosure,[2] in *Rabinowitz*, of a motor/generator that is identical to that expressly taught but with the exception that superconducting winding has been substituted for the bulk superconductor 62 in FIG. 6.

Applicant would consider conceding this point were it true that one could arrive at the claimed invention by simply substituting superconducting winding for the bulk superconducing material 62 in FIG. 6 of *Rabinowitz*. However, a superconducting material that has been drawn into a wire and coiled to form a winding is a fundamentally different structure from a superconducing bulk material.[3]

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[1] *Rabinowitz*, U.S. Patent No. 5,325,002

[2] *MPEP 2144.01.*

[3] Decisions finding implicit disclosure require only simple substitutions of steps, materials, or structure. For example in *In re Preda*, 401 F.2d 825 (CCPA 1968) the court found implicit disclosure of a process that included heating to 800 degrees because a reference that taught the claimed process at 700 degrees also suggested that one could carry out the process at a temperature above 750 degrees. In *In re Lamberti*, 545 F. 2d 747, (CCPA 1976), a disclosure of a compound R-S-R' having "at least one methylene group attached to the sulfur atom" impliedly taught that the other group could be non-methylene.

Unlike bulk material, a winding constrains current to flow in an annulus.[4] This circulating current funnels magnetic flux into the hole of the annulus, thereby causing the hole to define a "flux path" as recited in the claim. This is quite different from a bulk material, in which current is free to flow in two directions (in the case of laminar bulk material) or three directions. Where a bulk material is used, there is no well-defined flux path as there would be in a winding.

Given this fundamental physical difference between a winding and a bulk material, it is unclear that one could simply replace the superconducting material 62 with superconducting windings without also having to fundamentally alter the principle of operation of the motor/generator illustrated in FIG. 6. As a threshold matter, how are the windings to be oriented? *Rabinowitz* does not teach a preferred direction because the concept of "preferred direction" does not exist in the bulk materials taught by *Rabinowitz*.

In describing an advantage of his invention, *Rabinowitz* states that:

> "[b]ecause it is in a non-wire form, instead of one or more windings of wire, the motor/generator can be implemented with substantially any superconducting material"[5]

Thus, even *Rabinowitz* recognizes the fundamental distinction between a bulk superconducting material and a superconducting material draw into a wire. *Rabinowitz* has disclosed a motor/generator whose principle of operation is such as to accomodate bulk superconducting material. There is no reason to expect that the exact same motor/generator will also accomodate a superconducting winding.

The proposed modification would appear to require substantial changes to the *Rabinowitz* device. These changes would result in changes in the principle of operation of the *Rabinowitz*

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[4] "Annulus" is used loosely here, since the path need not be circular. For example, Applicant's illustrated embodiment shows an oval path.

[5] *Rabinowitz*, col. 5, line 64 to col. 6, line 3 [emphasis supplied].

device. Accordingly, a rejection based merely on the fact that *Rabinowitz* happens to include a sentence mentioning non-wire form and wire windings in the same breath is improper.[6]

It is apparent therefore that the *Rabinowitz* teaching of a motor/generator fails to teach, either expressly or by implication, an identical motor/generator having a superconducting winding substituted for the bulk superconducting material. At most, *Rabinowitz* suggests that, someplace in the world, there may exist a reference that teaches a motor incorporating, in some unspecified way, a superconducting winding. Whether this hypothetical references teaches, in addition to a superconducting winding, the remaining elements of the claimed invention arranged in the identical manner claimed by Applicant, is an open question. That the Office, after not one but two attempts, has failed to locate such a reference raises the distinct possibility that no such reference exists and that Applicant is the first inventor of the superconducting motor recited in claim 1.

The Examiner also draws attention to language in *Higashi*[7] that teaches a superconducting material integrated into a squirrel-cage rotor. The Examiner appears to suggest that a squirrel-cage rotor that incorporates a superconducting material amounts to a superconducting winding.

In a squirrel cage rotor, two conducting rings, placed at each end of the rotor, are connected by conducting bars that extend across the rotor. The conducting bars and the two conducting rings thus form a conductive cage (hence the term "squirrel cage"). As far as Applicant can tell, the Examiner considers any two conducting bars, in combination with the two conducting rings, to form one turn of a superconducting winding. This leads to the conclusion that the *Higachi* squirrel cage rotor is really a superconducting winding having as many turns as there are pairs of conducting bars.

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[6] *MPEP 2143.01*; see also *In re Raitti*, 270 F.2d 810 (CCPA 1959) ("suggested combination of references would require a substantial reconstruction of the elements shown")

[7] *Higashi*, U.S. Patent No. 4,885,494, issued December 5, 1989.

The flaw in this reasoning is that in a real superconducting winding, the individual turns of the winding cannot be short-circuited. In a winding, current must be forced to flow through each turn of the winding. It cannot be permitted to skip over any windings. This is because the magnetic field intensity generated by a current in a winding depends on the number of turns in the winding.[8] To allow current to take a short cut by skipping over one or more windings would effectively reduce the number of turns of the winding, thereby reducing its effectiveness.

In *Higashi*, this is plainly not the case. *Higashi* itself teaches that "a short circuit looped in itself is formed in a squirrel cage rotor comprising a plurality of bar conductor [sic] short circuited by two circular conductors opposite to each other".[9] The purported "winding" of *Higashi* is no more than cylindrically shaped conductive mesh. There is no notion in *Higashi* of a flux path as recited in Applicant's claim 1 because the bars extending axially across the rotor are not individual turns of a winding. They are, instead, individual bars of a cage.

It is therefore apparent that *Higashi* has no teaching of the superconducting winding absent in *Rabinowitz*. Accordingly, the combination of *Higashi* and *Rabinowitz* likewise has no such disclosure.

The remaining independent claims 17 and 21 each require a rotor assembly having "at least one superconducting winding which, in operation, generates a flux path within the rotor assembly." Accordingly, Applicant reasserts the foregoing arguments in connection with those claims.

Applicant submits that independent claims 1, 17, 21 and all claims dependent thereon are free of the cited art. Accordingly, Applicant requests allowance of those claims.

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[8] For example, *Physics, Part II*, Halliday and Resnick (John Wiley and Sons 1960 ed.) teaches that Ampere's law applied to a solenoid results in a field $B = \mu_0 nI$, where n is the number of turns.

[9] *Higashi*, col. 1, lines 11-15.

No additional fees are believed to be due in connection with the filing of this response. However, if additional fees are due, please charge our Deposit Account 06-1050.

Respectfully submitted,

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